Survey of early identification systems to identify inpatient children at risk of physiological deterioration

In the UK 70% of adult services have early warning systems and trigger systems to identify patients at risk of physiological deterioration. Methodological challenges, unvalidated criteria that are not universally applied and insufficient staff education have contributed to difficulties in proving benefit.[1]

The more rapid physiological decline experienced by children makes it remarkable that these services are not routinely available for children. As simply adapting adult systems for children is inappropriate because of different age-related physiological and developmental factors, there has been an attempt to develop tools specifically for use in the paediatric population.[2–6] This survey was designed to identify the prevalence and nature of paediatric early identification systems in the UK to inform future research, policy and the development of appropriate services for children.

Methods

A survey was sent to the lead paediatricians, intensivists, anaesthetists and critical care outreach leads of NHS Trusts in the UK caring for children. Personnel were identified from databases held by the Royal College of Paediatrics and Child Health, the Intensive Care National Audit and Research Centre, The Critical Care Directory (2003) and the Paediatric Critical Care Outreach Interest Group. The structured questionnaire, accompanied by an information leaflet, was sent by email and post between April and June 2005.

Results

A response was obtained from 189 hospitals representing 158 of 186 NHS Trusts (85% response rate). Non-responders were less likely to care for inpatient children. Duplicate replies were compared, with preference given to positive responses. Thirty one (21.5%) of the 144 NHS Trusts that care for children as inpatients, reported an early identification system with specific criteria that initiated a call for help. The demographics of the responding services were described as district general (15), tertiary general (four), tertiary children's (nine) and specialist neurology and orthopaedics (three). Nine hospitals had an on-site paediatric intensive care units and 14 had paediatric high dependency facilities.

Eight of the early warning systems appeared to be the same as or local modifications of two subsequently published tools.[2 3] Of the 36 different parameters used for early identification, respiratory rate, respiratory effort, heart rate, shock, and nurse and doctor concern were the most frequently used (table 1).

Discussion

This national cross-sectional survey of early warning systems has shown that 21.5% of the 144 NHS Trusts that care for children as inpatients have an early warning system, but there is no consistency of approach. None of the tools have been validated or shown to improve outcome and some do not take account of the significant differences between paediatric and adult physiology, as they either use or have simply adapted adult scores. The diversity of these systems using unvalidated criteria with numerous parameters reflects a similar pattern of development seen in adult practice.

After the survey was completed, a North American survey and four paediatric early warning systems were published. The survey of North American paediatric hospitals (>50 acute inpatient beds in more than two paediatric wards) similarly found that 24% had activation criteria for an urgent response team.[4] Retrospective Canadian and prospective UK case-control studies show sensitive identification of 75–90% of children at risk of life-threatening events, but unfortunately no outcome or economic data are reported.[2 5] An Australian observational study reported a significant reduction in preventable in-hospital cardiac arrest and mortality following the introduction an urgent response team with calling criteria.[6]

The main limitations of this study were the postal survey methodology and the relatively novel concept of paediatric early warning systems. Clearly, there will be ongoing development and a future survey should allow more detailed comparison of the demographics of paediatric services with and without systems, specific parameter thresholds, and the impact and outcomes that are being tracked. It is imperative that the current paediatric systems are properly evaluated before further ad hoc adoption.

Table 1 The 36 different parameters used for early identification

Parameter	Frequency	Parameter	Frequency
Respiratory rate	18	Diabetic ketoacidosis	5
Heart rate	17	Meningococcaemia	5
Nurse concern	16	Acidosis	5
Doctor concern	14	Abnormal serum potassium	5
Respiratory effort	13	Fluid bolus >10 ml/kg	5
Shock	12	Artificial airway	4
Systolic blood pressure	11	Abnormal serum sodium	4
Oxygen saturation	11	Abnormal coagulation	4
Abnormal consciousness	11	Inotrope infusion	4
Oxygen therapy	10	Apnoea	3
Stridor/wheeze	8	Arrhythmia	3
Post ICU discharge	8	Mean blood pressure	3
Nebulised medication	8	Neutropaenia	2
Urine output	7	Central line (temporary)	1
Temperature	7	Cardiac pacing (temporary)	1
Exhaustion	6	Major trauma	1
Prolonged seizure	6	Burns >10%	1
Respiratory arrest	5	Need for ventilation	1

Contributions and guarantor

Dr Heather Duncan contributed to the design, has analysed the data and stands guarantor for accuracy, and has prepared the scientific report. Dr Roger Parslow, Paediatric Epidemiology Group at the University of Leeds, contributed to the design and supervised data collection and database administration. Adam Wingfield, Paediatric Epidemiology Group at the University of Leeds, managed the database. Ms Caroline Haines contributed to the survey design and information sheet. The Paediatric Early Warning System (PEWS) Investigators Jacques Lacroix and Catherine Farrell (CHU Ste. Justine, Montreal, Quebec, Canada), Ari Joffee (Stollery Children's Hospital, Edmonton, Alberta, Canada), Heather Duncan (Birmingham Children's Hospital, Birmingham, England), and James Hutchison and Christopher Parshuram (Hospital for Sick Children, Toronto, Ontario, Canada) contributed to the design and editorial expertise. The PEWS Investigators are supported by the Heart and Stroke Foundation of Canada and the Birmingham Children's Hospital Research Foundation.

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Introduction of a paediatric pain management protocol improves assessment and management of pain in children in the emergency department

We have demonstrated the success of a pain scoring system and corresponding analgesia